REMARKS

This application has been reviewed in light of the Office Action dated November 26, 2002. Claims 1-15 are presented for examination, of which Claims 1, 4, and 10 are in independent form. None of the pending claims have been amended by the present Response.

Claims 1-15 stand provisionally rejected under the judicially created doctrine of obviousness-type double patenting, as being unpatentable over Claims 1-16 of U.S. Patent Application No. 09/865,549 in view of U.S. Patent No. 6,028,264 (Yamazaki '264) and U.S. Patent No. 5,556,794 (Yamazaki '794). Applicants note that the rejections are provisional ones and, in view of the fact that to date no Office Action has issued in Application No. 09/865,549, it is not necessary to respond to the rejections at this time.

The Office Action rejected Claims 1-7 and 10-13 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,571,749 (Matsuda et al.) in view of Yamazaki '264 and Yamazaki '794. Claims 8 and 14 stand rejected under § 103(a) as being unpatentable over Matsuda et al. in view of Yamazaki '264 and Yamazaki '794, and further in view of Japanese Publication No. 2000-077694 (Tokawa). Claims 9 and 15 stand rejected under § 103(a) as being unpatentable over Matsuda et al. in view of Yamazaki '264 and Yamazaki '794, and further in view of Japanese Publication No. 11-310495 (Kondo).

Applicants submit that independent Claims 1, 4, and 10, together with the claims dependent thereon, are patentably distinct from the cited prior art for at least the following reasons.



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The aspect of the present invention set forth in Claim 1 is directed to a process for forming a silicon-based thin film by high-frequency plasma CVD (chemical vapor deposition). The process utilizes silicon fluoride and hydrogen contained in a material gas. Oxygen atoms are incorporated in the material gas in a concentration of from 0.1 ppm to 0.5 ppm, based on a concentration of silicon atoms.

One important feature of Claim 1 is that the process utilizes an oxygen content in the material gas within a range of 0.1 to 0.5 ppm, based on the concentration of silicon atoms. By virtue of this feature, the silicon-based thin film formed by the process has an enhanced crystallinity and crystal orientation. That is, according to the process of Claim 1, intensification of crystallinity and crystal orientation in a silicon-based thin film is achieved by controlling the oxygen content in a material gas containing silicon fluoride and hydrogen.

Matsuda et al. relates to a plasma CVD method for forming a thin film, wherein the substrate temperature changes rapidly before and after deposition to prevent diffusion of impurities. The Office Action cites Matsuda et al. for disclosing "a method for producing silicon thin films, particularly for use in solar cells, using high-frequency plasma CVD."

Yamazaki '264 and Yamazaki '794, as understood by Applicants, relate to methods for producing semiconductor layers. An object of both Yamazaki '264 and Yamazaki '794 is to reduce the oxygen content in a silicon semiconductor layer to thereby reduce the density of recombination centers in the silicon semiconductor layer.

Applicants submit that a combination of Matsuda et al., Yamazaki '264, and



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Yamazaki '794, assuming such combination would even be permissible, would fail to teach or suggest a process for forming a silicon-based thin film, wherein a material gas of silicon fluoride and hydrogen is used, and the material gas contains an oxygen content of 0.1 to 0.5 ppm, based on the concentration of silicon atoms, as claimed in Claim 1.

As mentioned above, Yamazaki '264 and Yamazaki '794 are understood to disclose that by reducing the oxygen content in a silicon layer, the density of recombination centers in the silicon layer is reduced. In contrast, the process of Claim 1 utilizes a specific oxygen content in a material gas of silicon fluoride and hydrogen, wherein the oxygen content is within 0.1 to 0.5 ppm, based on the concentration of silicon atoms. This oxygen-content range provides the benefit of enhancing the crystallinity and crystal orientation of the resultant silicon-based film formed using the material gas.

Applicants believe that both Yamazaki '264 and Yamazaki '794 may actually *teach away* from Claim 1, because those references are understood to teach *removing* as much oxygen as possible from the material gas used to form a "non-single-crystal semiconductor layer." (See, for example, column 6, lines 20, *et seq.* of Yamazaki '264: "[T]he semicondutor raw material gas is one that is obtained by passing a semiconductor raw material gas through a molecular sieve or zeolite which adsorbs oxygen . . . ") Therefore, one of ordinary skill in the relevant art would not find any suggestion to use a material gas with an oxygen content within a *specified range*, as claimed in Claim 1. Applicants respectfully submit that the feature of Claim 1 discussed above, in which crystallinity and crystal orientation is enhanced by the claimed process, has no relation to either of the Yamazaki references, which are directed to forming *non-*



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*single-crystal* semiconductor layers and reducing oxygen contamination. More specifically, Applicants respectfully submit that one of ordinary skill would understand that the Yamazaki references are directed to forming amorphous semiconductor layers (see column 5, lines 36-39, of Yamazaki '264), so enhancement of crystallinity and crystal orientation is not contemplated.

Accordingly, Applicants submit that Claim 1 is patentable over the cited art, and respectfully request withdrawal of the rejection under 35 U.S.C. § 103(a). Independent Claims 4 and 10 include a feature similar to that discussed above, in which a specified content of oxygen is incorporated in a material gas of silicon fluoride and hydrogen, which is used to form a silicon-based layer. Therefore, those claims also are believed to be patentable for at least the same reasons as discussed above.

The other rejected claims in this application depend from one or another of the independent claims discussed above and, therefore, are submitted to be patentable for at least the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, individual reconsideration of the patentability of each claim on its own merits is respectfully requested.

In view of the foregoing remarks, Applicants respectfully request favorable reconsideration and early passage to issue of the present application.



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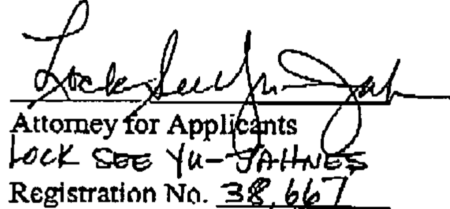
Applicants' undersigned attorney may be reached in our New York Office by telephone at (212) 218-2100. All correspondence should continue to be directed to our address listed below.

Respectfully submitted,



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